REMARKS

In the Office Action, dated June 28, 2002, the Examiner states that Claims 1-28 are pending and Claims 1-28 are rejected. By the present Amendment, Applicants amend the claims.

In the Office Action, the Patent Office rejects Claims 18-21 and 27 under 35 USC §112, second paragraph, for containing limitations with insufficient antecedent basis. The Applicants have amended Claims 18 and 27 to correct this.

In the Office Action, the Patent Office rejects Claims 1, 5-6 and 28 under 35 USC §102(b) as anticipated by either US 5,817,441 or US 5,908,721. Claims 1-6 and 28 are rejected under 35 USC §102(b) as anticipated by EP 0,665,449.

The Applicants have amended Claim 1 to incorporate the limitations of Claim 7. The Applicants consider the amended claims to overcome the rejections for the reasons further set out below.

In the Office Action, the Patent Office rejects Claims 1-7, 10-11, 14 and 16-28 under 35 USC §102(e) as anticipated by US 6,399,257. Applicants consider this rejection overcome because US 6,399,257 is not a proper reference which may be cited against the claims under §102(e).

35 USC §102(e) states that a person shall be entitled to a patent unless the invention was published in an English language application or disclosed in a US patent which was filed in the US before the Applicant's date of invention. The latest priority date of the present application is October 1, 1999 while US 6,399,257 was not published before that date nor was filed (March 3, 2000) before that date. Therefore, US 6,399,257 is not a proper reference under 35 USC §102(e), and that rejection is overcome.

In the Office Action, the Patent Office rejects Claims 1-28 under 35 USC §102(b) as anticipated by WO 99/08158. Applicants respectfully disagree with this rejection.

The present invention relates to a color filter which does not comprise a shading part (black matrix). The object of the invention is to solve a difficult problem where an accurate picture element part is formed by an ink jet system without forming the shading part which is a convex part on a substrate.

In order to solve the above problem, the present invention provides a wettability-variable layer, in which the wettability can be changed by exposing the energy through the photocatalyst-containing layer, and has the advantage that the accurate print element part is provided on the wettability-variable layer without the shading part by using the ink jet system.

WO 99/08158 discloses only the color filter with the shading part, and neither discloses or suggests at all the color filter without the shading part.

The present invention has the advantage that the accurate print element part is provided on a flat transparent substrate without the shading part by using the ink jet system. This advantage is achieved from the combination of the color filter without the shading part and the photo-catalyst containing layer. Therefore, the present invention cannot be considered to be anticipated by the color filter with the shading part described in WO 99/08158.

In light of the foregoing response, all the outstanding objections and rejections have been overcome. Applicants respectfully submit that this application should now be in better condition for allowance and respectfully request favorable consideration.

Respectfully submitted,

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Date

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DOCKET: CU-2263

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Masato Okabe et al.	)
SERIAL NO:	09/607,010	) Group Art Unit: 1756
FILED:	June 29, 2000	) Examiner: J.A. McPherson

TITLE: Color Filter and Process for Producing the Same

THE ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

MARKED VERSION OF AMENDED CLAIMS

1. A color filter, **in which a shading part provided on a border part of a picture element part is not formed**, comprising a transparent substrate, the picture element part provided on the transparent substrate by a pattern of a plurality of colors with an ink jet system, and **[a wettability-variable layer] a photocatalyst-containing layer, [in which a wettability can be changed,]** provided for forming the picture element**, including at least a photocatalyst and a binder, and having the wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation**.

2. The color filter according to Claim 1, wherein **[the wettability-variable layer] the photocatalyst-containing layer** is provided on the transparent substrate, and the picture element part is provided on **[the wettability variable layer] the photocatalyst-containing layer**.

3. The color filter according to Claim 2, wherein a space between the picture element parts is not more than 2 μm.

4. The color filter according to Claim 2, wherein an ink-repellent convex part is formed on the wettability variable layer at a boundary portion of the picture element part.

5. The color filter according to Claim 1, wherein the picture element part is provided on the transparent substrate, and **[the wettability-variable layer] the photocatalyst-containing layer** is provided on a border portion between the picture element parts.

6. The color filter according to Claim 5, wherein a wettability on the transparent substrate is less than 10 degrees in terms of the contact angle with a liquid having the surface tension of 40 mN/m.

7. **CANCELLED**

8. The color filter according to Claim [7] 1, wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation.

9. The color filter according to Claim 8, wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy.

10. The color filter according to Claim [7] 1, wherein the photocatalyst is one or more substances selected from the group consisting of titanium oxide (TiO_2), zinc oxide (ZnO), tin oxide (SnO_2), strontium titanate ($SrTiO_3$), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3) and iron oxide (Fe_2O_3).

11. The color filter according to Claim 10, wherein the photocatalyst is titanium oxide (TiO_2).

12. The color filter according to Claim 11, comprising the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer at a rate of 500 or more relative to 100 of Ti element as determined by an X-ray photoelectron spectroscopy.

13. The color filter according to Claim [7] 1, wherein the binder is organopolysiloxane having a fluoroalkyl group.

14. The color filter according to Claim [7] 1, wherein the binder is organopolysiloxane which is a hydrolyzed and condensed compound or co-hydrolyzed and condensed compound of one or more of silicon compounds represented by $Y_nSiX_{(4-n)}$ wherein Y represents alkyl group, fluoroalkyl group, vinyl group, amino group, phenyl group or epoxy group, X represents alkoxyl group or halogen, and n is an integer of 0 to 3.

15. The color filter according to Claim 14, wherein a silicon compound having a fluoroalkyl group among the silicon compounds constituting the organopolysiloxane is contained at an amount of 0.01 mol% or more.

16. The color filter according to Claim ~~[7]~~ 1, wherein a contact angle with a liquid having the surface tension of 40 mN/m on the photocatalyst-containing layer is not less than 10 degrees at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

17. The color filter according to Claim ~~[7]~~ 1, wherein the picture element part colored with an ink jet system is a picture element part colored with an ink jet system using a UV-curing ink.

18. A process for producing a color filter, which comprises:

(1) a step of providing a photocatalyst-containing layer having ~~[the]~~ a wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

(2) a step of forming an exposed part for a picture element part by pattern-irradiating with the energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

(3) a step of coloring the exposed part of a picture element part with an ink jet system, to form a picture element part.

19. The process for producing a color filter according to Claim 18, wherein the step of forming an exposed part for a picture element part, then coloring the part with the ink jet system to form the picture element part, comprises steps:

(a) a step of forming an exposed part for a first picture element part by pattern-irradiating with the energy on a part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed;

(b) a step of forming the first picture element part by coloring the exposed part for a first picture element part with the ink jet system;

(c) a step of forming an exposed part for a second picture element part by irradiating with the energy on a remaining part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed; and

(d) a step of forming the second picture element part by coloring the exposed part for a second picture element part with the ink jet system.

20. The process for producing a color filter according to Claim 18, wherein an exposed part for an ink-repellent convex part is to be formed, is formed before formation of the exposed part for a picture element part, then the ink-repellent convex part is formed on the exposed part for an ink-repellent convex part through using resin composition.

21. The process for producing a color filter according to Claim 20, wherein the ink-repellent convex part is formed between the picture element parts.

22. A process for producing a color filter, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of an energy irradiated part which changes in a direction of reduction of a contact angle with a liquid, at a boundary portion of a picture element part forming portion on which the picture element part is to be formed, on a transparent substrate; and

(2) a step of forming the picture element part on the picture element part forming portion on the transparent substrate.

23. The process for producing a color filter according to Claim 22, wherein the wettability on the transparent substrate is less than 10 degrees as a contact angle with a liquid having the surface tension of 40 mN/m.

24. The process for producing a color filter according to Claim 18, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

25. The process for producing a color filter according to Claim 22, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

26. The process for producing a color filter according to Claim 18, wherein a coloring of the exposed part for a picture element part with the ink jet system is the coloring with the ink jet system using a UV-curing ink.

27. The process for producing a color filter according to Claim 22, wherein a coloring of **[the]** **an** exposed part for a picture element part with **[the]** **an** ink jet system is the coloring with the ink jet system using a UV-curing ink.

28. A liquid crystal panel comprising a color filter according to Claim 1 and a substrate, which are opposite to the color filter, and provided a shading part, wherein a liquid crystal compound is encapsulated between both substrates.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: Color Filter and Process for Producing the Same

THE ASSISTANT COMMISSIONER FOR PATENTS
Washington, D.C. 20231

CLEAN VERSION OF AMENDED CLAIMS

A1

1. A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, the picture element part provided on the transparent substrate by a pattern of a plurality of colors with an ink jet system, and a photocatalyst-containing layer, provided for forming the picture element, including at least a photocatalyst and a binder, and having the wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation.

2. The color filter according to Claim 1, wherein the photocatalyst-containing layer is provided on the transparent substrate, and the picture element part is provided on the photocatalyst-containing layer.

NE 3. The color filter according to Claim 2, wherein a space between the picture element parts is not more than 2 μm.

NE 4. The color filter according to Claim 2, wherein an ink-repellent convex part is formed on the wettability variable layer at a boundary portion of the picture element part.

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5. The color filter according to Claim 1, wherein the picture element part is provided on the transparent substrate, and the photocatalyst-containing layer is provided on a border portion between the picture element parts.

NE 6. The color filter according to Claim 5, wherein a wettability on the transparent substrate is less than 10 degrees in terms of the contact angle with a liquid having the surface tension of 40 mN/m.

8. The color filter according to Claim 1, wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation.

9. The color filter according to Claim 8, wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy.

10. The color filter according to Claim 1, wherein the photocatalyst is one or more substances selected from the group consisting of titanium oxide (TiO_2), zinc oxide (ZnO), tin oxide (SnO_2), strontium titanate ($SrTiO_3$), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3) and iron oxide (Fe_2O_3).

11. The color filter according to Claim 10, wherein the photocatalyst is titanium oxide (TiO_2).

12. The color filter according to Claim 11, comprising the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer in which fluorine element is contained in a surface of the photocatalyst-containing layer at a rate of 500 or more relative to 100 of Ti element as determined by an X-ray photoelectron spectroscopy.

13. The color filter according to Claim 1, wherein the binder is organopolysiloxane having a fluoroalkyl group.

14. The color filter according to Claim 1, wherein the binder is organopolysiloxane which is a hydrolyzed and condensed compound or co-hydrolyzed and condensed compound of one or more of silicon compounds represented by $Y_nSiX_{(4-n)}$ wherein Y represents alkyl group, fluoroalkyl group, vinyl group, amino group, phenyl group or epoxy group, X represents alkoxyl group or halogen, and n is an integer of 0 to 3.

15. The color filter according to Claim 14, wherein a silicon compound having a fluoroalkyl group among the silicon compounds constituting the organopolysiloxane is contained at an amount of 0.01 mol% or more.

16. The color filter according to Claim 1, wherein a contact angle with a liquid having the surface tension of 40 mN/m on the photocatalyst-containing layer is not less than 10 degrees at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

17. Th color filter according to Claim 1, wherein the picture element part colored with an ink jet system is a picture element part colored with an ink jet system using a UV-curing ink.

18. A process for producing a color filter, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

(2) a step of forming an exposed part for a picture element part by pattern-irradiating with the energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

(3) a step of coloring the exposed part of a picture element part with an ink jet system, to form a picture element part.

19. The process for producing a color filter according to Claim 18, wherein the step of forming an exposed part for a picture element part, then coloring the part with the ink jet system to form the picture element part, comprises steps:

(a) a step of forming an exposed part for a first picture element part by pattern-irradiating with the energy on a part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed;

(b) a step of forming the first picture element part by coloring the exposed part for a first picture element part with the ink jet system;

(c) a step of forming an exposed part for a second picture element part by irradiating with the energy on a remaining part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed; and

(d) a step of forming the second picture element part by coloring the exposed part for a second picture element part with the ink jet system.

20. The process for producing a color filter according to Claim 18, wherein an exposed part for an ink-repellent convex part is to be formed, is formed before formation of the exposed part for a picture element part, then the ink-repellent convex part is formed on the exposed part for an ink-repellent convex part through using resin composition.

NE 21. The proc ss for producing a color filter according to Claim 20, wherein the ink-repellent convex part is formed between the picture element parts.

NE 22. A process for producing a color filter, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of an energy irradiated part which changes in a direction of reduction of a contact angle with a liquid, at a boundary portion of a picture element part forming portion on which the picture element part is to be formed, on a transparent substrate; and

(2) a step of forming the picture element part on the picture element part forming portion on the transparent substrate.

NE 23. The process for producing a color filter according to Claim 22, wherein the wettability on the transparent substrate is less than 10 degrees as a contact angle with a liquid having the surface tension of 40 mN/m.

NE 24. The process for producing a color filter according to Claim 18, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

NE 25. The process for producing a color filter according to Claim 22, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

NE 26. The process for producing a color filter according to Claim 18, wherein a coloring of the exposed part for a picture element part with the ink jet system is the coloring with the ink jet system using a UV-curing ink.

27. The process for producing a color filter according to Claim 22, wherein a coloring of an exposed part for a picture element part with an ink jet system is the coloring with the ink jet system using a UV-curing ink.

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NE 28. A liquid crystal panel comprising a color filter according to Claim 1 and a substrate, which are opposite to the color filter, and provided a shading part, wherein a liquid crystal compound is encapsulated between both substrates.